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Bathing, Cupping, Electricity, Massage.

A COMPARISON OF THE

THERAPEUTIC EFFECTS OF BATHING, OF CUPPING OR ATMOSPHERIC EXHAUSTION, OF ELECTRICITY IN THE FORM OF GALVANISM AND FARADISM, AND OF MASSAGE, IN THE TREATMENT OF DEBILITIES, DEFORMITIES AND CHRONIC DISEASES.

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It is expected that each specialist who relies upon one of these four agents, over-estimates its relative importance, and his consequent over-praise leads the general practitioner to despise these agents, all alike, as the hobby-horses of charlatans. It is attempted in this short paper, to present their modes of action in comparison with each other, and to discriminate the conditions in which one is indicated in preference to another. It is believed that by securing to each its proper therapeutic position, it will have a stronger hold upon public confidence, and will therefore be oftener as well as more intelligently employed.

Bathing is applicable in some of its forms to all conditions. All varieties of its applications, as of all active agents, are attended by a corresponding capability of doing harm where they are intended to do good. It is applicable to inflammatory and febrile excitements with elevation of temperature when so applied as to abstract heat directly, or so as to favor perspiration and evaporation thus indirectly diminishing the temperature. It is applicable to cases of arterial capillary contraction and diminished temperature, acting by the direct impartation of heat, and by the enlargement of the vessels for the supply of blood. It is efficacious in the removal of cutaneous obstructions to the transudation of effete material; and in wounds it protects the surface from the lodgement of the germs of putrefaction floating in the air, and thus acts as an antiseptic. This property may be reinforced by carbolic acid and salicylic acid.

The efficacy of bathing by immersion or by fomentation is such as to give the surgeon little concern, whether an injury is subcutaneous or open through the skin. Such is the antiseptic action of water perpetually changed and of water medicated with these acids and applied to wounds and to erysipelatous inflammations, as to diminish the importance of season and climate, in the estimate of danger. By what bathing is in itself and by what it is the vehicle of, it occupies an exceedingly large space in the field of therapeutics.

Bathing is made the vehicle of heat and cold, from the utmost limits of endurance to the slightest variation from the existing temperature. When in either extreme, the action upon the nerves is that of a counter-irritant, and the action upon the vessels is to contract them, securing an arrest or a diversion of the flow of the blood. When of a temperature near that of the surface, the effects are soothing upon the nerves and relaxing upon the vessels. The saline ingredients of the waters of various natural springs can be closely imitated by the addition of salts artificially prepared, but the charm of travel and of scenery cannot be supplied by any artificial device devoid of the mystery of natural healing. A bath impregnated with the saline ingredients of sea-water ought to be as efficacious as a bath in the sea itself, except that the appeals to the imagination constitute a part of the cure.

The application of hot air impregnated with vapor, simple or medicated, is generally intended to excite free perspiration and the elimination of all material capable of transudation. Mercurial and other medicated vapors are capable of imparting their ingredients to the system through cutaneous absorption.

Cupping, or atmospheric exhaustion, is familiar to every one when applied on an area of three or four inches, but when applied to a whole limb, or to the limbs and the whole trunk, it is chiefly known as it is practiced by some specialists. The amount of blood abstracted from the general circulation is incapable of accounting for the success of ordinary cupping in relieving pain; and from the similarity of the result to that of counter-irritants, the agent must be classed among them. When, however, a whole extremity or any considerable part of the body is made the field for exhaustion, the principle of action changes.

Cupping, or the vacuum process is applied to a large surface, not as a revulsive or counterirritant, but as an aid to the nutrition of the subjacent parts through the temporary accumulation of the nutrient fluid with the necessary enlargement of the vessels which carry them. It is obvious that the long continuance of the application must fail of the object, by retarding the rapid circulation by which the fluid present at any one moment is replaced by another supply coming direct from the lungs in which the effete carbon is discharged and a fresh supply of oxygen taken in. The process secures an enlargement of the vessels, by simple distension, while the enlargement which comes through vibratory passive movements and through active exercise, is secured by the direct demand of the tissues for more blood.

The presence of fluids within the vessels and within the connective tissue, as well as the tendency to the vaporization of gases condensed in these fluids, make, obviously, an influence to enlarge contracted vessels, and to loosen the tightness of contracted or hardened tissues. When applied to the trunk and limbs covering the whole body, except the head and neck, the lungs must be first to feel the expanding influence similar to that experienced in the ascent of high mountains, with the same danger of hemorrhage.

Junod's boot, a metallic enclosure for a leg or an arm, the air being withdrawn by an air pump, has been used many years in France and is recommended by Brown-Sequard, in the treatment of peripheral paralysis. In this country the apparatus is extended so that, in one form the trunk (up to the neck) is inclosed, and subjected to atmospheric exhaustion.

Employed on a large surface, atmospheric exhaustion is a valuable agent with a limited field of application.

Electricity, in its therapeutic relations, is now known under three names, employed to designate different modes:

1. Franklinism, or static electricity, denotes the agent as developed by friction. So little therapeutic use is now made in this form, that it will not be considered.

2. Faradism, or induced electricity, named after Faraday, its chief discoverer, is now more used than any other form, chiefly on account of the cheapness of the apparatus by which it is developed, and the very sensible effect of its application. It is developed by induction from the galvanic or chemical current intensified by a magnetic arrangement, the apparatus being sometimes called an eletro-magnetic arrangement. It is also developed by an apparatus in which, by turning a crank temporary magnets are made to revolve across the poles of a horse-shoe magnet inducing in the turns of wire with which the temporary magnets are surrounded electric inductions which are broken and renewed with a rapidity proportioned to the revolutions. The excellence of the apparatus consists in the adjustments by which the intensity or sharpness of the shocks and their rapidity may be regulated to suit the objects of the application whether to excite muscular contraction in sluggish muscles, or a tetanic condition, in which a perpetual tension is manifested. If a careless writer speaks of using electricity, it may be assumed that faradism is the form understood.

3. Galvanism is current electricity as developed by chemical action.

In accordance with these terms are the names of the therapeutic processes. Faradization and galvanization are capable of effecting the deepest parts as well as the most superficial, and the most primary acts of tissue change. Functions sluggishly performed can be stimulated to greater activity, whether the defect be in muscular motion, nervous sensation, vascular supply, quantity and character of secretion, or the quality of the nutrition. The application is therefore, very varied, but not without danger of misapplication and injury.

Faradization is the name adopted for the application of the induced current, which must be in shocks of rapid succession. The beginning and the end of each brief electric flow is attended by a shock, by which the muscles are thrown into a tetanic tension; and the sensitive nerves excited to their natural function.

Galvanization is the name adopted for the application of the continuous or chemical current obtained by the reinforcement of cells, the energy of one adding to that of the next, until a propelling force is obtained

sufficient to overcome the resistance of the body. The continuity of the current may be interrupted by the hand or by automatic mechanism, but its chemical power remains the same, in proportion to the duration of its flow. The sensational and muscular effects may be increased by the interruptions, but a galvanometer needle will show a reduction of the amount of current passing, proportioned to the duration of the intervals of no current. Thus, while the current appears stronger, it is really less in amount.

Variations in the character of the current are made with reference to the objects to be accomplished. When the force of the current in relation to its diffusion is moderate, a tendency to disintegration is produced with an increased vascular activity.

The most probable explanation of the relief of pain is, that the pain itself depends upon anæmia of the nerves involved, and that the increased supply of blood, implying an expansion of the vessels, brings the functions of the nerves to a higher level than that of pain. This is rendered probable from the experience, that pains attendant upon conditions of inflammatory congestion are liable to be aggravated by galvanization. Such is the tendency of the galvanic current to diffusion, in passing through parts of considerable depths, that a strong force is necessary to produce any marked effect. This implies that the current is spread out over several inches of surface; so as to be borne without inducing the destructive action on the skin which is dependent upon the confinement of the current to a small space.

On the other hand, when the therapeutic indication is the absorption of tissue, the current is confined in a small space by means of needles. Whether the points are applied upon the surface or introduced at whatever depth, a decomposition takes place, the oxygen and the acids going to the positive pole, and the hydrogen and the alkalies going to the negative. The one or the other set of decomposition can be secured by substituting a wet sponge for one of the needles.

If it is intended to produce the internal development of hydrogen, for minute separation of the constituents of formations, as in tumors and neoplastic deposits, the negative needle is employed, while a sponge upon the surface makes the positive pole, or scope of direction for oxygen and acids. The needle inserted into the part to be electrolyzed may be an ordinary steel sewing needle. This constitutes the negative apex of a cone the positive base of which is the area of surface covered by the sponge, which, for the best action, should be placed upon the part of the surface opposite the point of the needle. The electric force crowds to the point of the needle, making it unnecessary to insulate the metallic surface.

In order to secure this immunity from the necessity for insulating the needle it is necessary that the opposing sponge shall be in the direction of the needle; otherwise the force will pass off along the surface of the needle which is directed towards the sponge. In introducing a bougie into the urethra for the treatment of strictures, it is of great importance to attend to this point.

If oxydation and coagulation are desired, as in the treatment of aneurism by coagulation, the sponge is made the negative and the needle the positive pole. In this case the needle must be of solid platinum or gold, so as not to oxydize; a thin plating is peeled off by the current, and is therefore worse than useless. When it is desired to destroy the tissues, as in the treatment of vascular growths, as in aneurism by anastomosis, two needles are introduced, one which takes the oxygen liberated by the electrolysis by which the vitality of the parts immediately around the positive needle is destroyed, while the parts around the negative needle are infiltrated and disintegrated by hydrogen.

Between the extremes of destruction of tissues by the needle, by a greatly reinforced current, and the feeblest molecular change secured by a current of feeblest power, with reference to such a change of nutrition as may arrest a morbid growth in which the persistence in mal-nutrition is slight, or with reference to a grade of change in the innervation upon which the various pains and discomforts are dependent, are all the grades of therapeutic action. It does not come within the scope of this paper to discuss the employment of the heated platinum wire for surgical purposes. The therapeutic application is very wide. The power of the interrupted current, either galvanic or faradic, to excite contraction in parietic muscles, and thus to aid in restoring their lost functions, is well known, but the power of restoring sensation is not generally recognized. An observation upon this point was made upon the back of the hand of a gentleman, whose hand had been parietic for several months from what had been supposed to be a rheumatic attack. After partial restoration of function under the employment of these four agents—bathing, cupping, electricity and massage—a careful observation was made at one of the sittings. The faradic current was made to pass through the insensible part without being felt by the patient. In a few seconds sensation was developed, and in a few minutes became uncomfortably intense.

Bathing and electric excitations are especially agreeable companions in the relief of a great variety of irritable conditions. The electric bath, whether topical or general, is a combination of which each agent favors the action of the other, in cases in which it is not intended to act primarily upon the surfaces. The effect of water is to diffuse the current, and to enable it to pass through the skin with very little sensation, so that a patient thinks that he is having a feeble application when it is really strong.

The combination of bathing is generally made with the faradic current for general application. It is not uncommon, however, to apply the galvanic current while a foot or hand is in a bath, which is made one of the poles of the current. This method can be reversed, making a small region out of the bath the seat of the pole, while the general immersion gives the other pole a wide distribution.

Massage is now adopted as an arbitrary word, signifying friction, stroking, kneading, tapping, rolling, pinching, and passive movements, wheth-

er done with the patient awake or under ether; executed by the hand or by machinery, light in degree or carried to the extent of rupturing adhesions and elongating contracted muscles by short vibratory movements.

The principles are old, though the word employed to comprehend them is modern. The employment of friction by the hand is a domestic procedure, in pains and cramps, so ancient and universal as to scarcely be mentioned in systematic writings.

Friction is made by a rapid movement with light pressure, intended to develop heat in a part whose circulation is torpid from external cold or from internal causes: and when done by machinery, the presence of flannel or silk between the friction pad or brush and the skin, may be supposed to develop a static electric excitation, favorable to the restoration of the function of impaired nerves. The efficient employment of friction by the hand is very tiresome, and when employed in a systematic way to improve a chronic condition, a machine is almost indispensable.

Stroking is a combination of friction and pressure, generally secured by a movement of the hand in the direction of cutaneous hairs. This method of massage is especially applicable to the back and to the voluminous portions of the extremities. If it is intended to give prominence to the element of friction, the hand of the masseur is either dry or wet with alcohol, or some other penetrating or quickly evaporating liquid; but if pressure is intended to be predominant, the hand is lubricated with some oleaginous substance, which enables it to glide with the least resistance. As the hand passes slowly along the parts operated upon, a wave is produced which secures an alternate emptying and filling of the vessels of the stagnant organs. The influence of this method is felt not only in the parts subjected to the immediate pressure, but in the adjacent organ. This is illustrated by the relief of stroking in lumbago and other forms of backache in which the area of the comfort is more extensive than that of the application.

The process of kneading is the production of a pressure by the application of the hand or closed fist, with gliding, and in a gentle manner, over a portion of the body in alternation, as a baker kneads his dough.

Tapping is best secured by machinery, as it is very fatiguing to keep up a sufficient prolongation of rapid and light touches by the hand. Rolling however, being a slower proceeding, is easily affected by the hand. Pinching between thumb and finger is generally employed for the purpose of securing reflex action.

The various passive movements may be executed by the hand, but they are more regular and more efficiently produced by machinery. The latter can be moved by a stupid person, or by an engine, leaving the operator free to guide the machine without fatigue, and thus to secure the full benefit of the application of the remedy. While it is possible to do by hand, nearly all that can be done by machinery, it is safe to say that the use of the hand involves too much fatigue for general or faithful employment.

Dr. S. Weir Mitchell, in his recent book entitled "Fat and Blood," * gives the following description of his method of massage as applied to very feeble persons, who are at the same time deprived, to the greatest possible degree, of action or voluntary movement:

"An hour is chosen midway between two meals, and the patient, lying in bed, the manipulator starts at the feet, and gently, but firmly pinches up the skin, rolling it lightly between the fingers, and going carefully over the whole foot; then the toes are bent and moved around in every direction, and the foot is next kneaded and pinched with the thumb and fingers more largely, and the inter-osseous groups worked at with the finger tips between the bones. At last the whole tissues of the foot are seized with both hands and somewhat firmly rolled about. Next the ankles are dealt with in like fashion, all the crevices between the articulating bones being sought out and kneaded, while the joint is put into every possible position. The leg is next treated, first by surface pinching, then by deep grasping of the areolar tissue, and at last by industrious and deeper pinching of the large muscular masses, which for this purpose are put into a position of the utmost relaxation. The grasp of the muscles is momentary, and for the large muscles of the calf and thigh, both hands act, the one contracting while the other loosens its grip."

A similar proceeding is practiced upon the upper limbs and the trunk.

The movements described in this process must be so fatiguing as not to be faithfully performed except by a *workman*, whose arms are specially developed for the purpose. The production of heat and the enlarging of the capillaries by the rapid movement of machinery greatly exceed what can be secured by the application of the fingers.

Rapid vibrations or oscillations are beyond the power of the hands to accomplish. The rapidity of motion effected by machinery is necessary to a satisfactory result. The passive movements in imitation of the natural movements require skill when performed by the hand. The manipulation of the fingers, however, especially in stroking and kneading processes, can best be done by the hand of the operator. The movements of the fingers in the direction of flexion and extension are best done by machinery. The rapid oscillations, which are found of the greatest benefit, cannot be accomplished by the unaided hand.

The benefit seems to be derived from the acceleration of vital changes, similar to those which follow active exercise with those who are able to take it. A limb, useless through fancy, rigidity, or palsy, has its tissue shaken by short and rapid vibrations, and there comes a more voluminous supply of blood, and a more responsive or a more equable innervation.

The most important application of massage can be secured by the machine represented in the accompanying wood-cut, shown on the next page.

The *Manipulator*, a machine for massage, invented by Dr. George H. Taylor, of New York, and manufactured by Wood & Co., No. 17 East Fifty-eighth street, is a machine of very varied adaptation. It is capable of being run by hand, and accomplishing most of the work capable

* *Fat and Blood, and How to Make Them*, by S. Weir Mitchell, Philadelphia: J. B. Lippincott 1878.

of being done by extensive machinery requiring an engine.

The use of machinery marks a new era in the employment of this therapeutic agent.

In a large portion of the chronic disabilities of the extremities, a contraction of the arteries is a marked condition. The supply of heat becomes insufficient to keep up the proper temperature; and new material is not readily laid down to take the place of that which is effete; hence there is emaciation of the muscles, of vessels, and connective tissue. The diminution of volume, and density of the structure of the connective tissue, result in stiffening of the joints, the surrounding loose tissue acquiring the hardness of natural ligament, in some instances resisting with more force than the strength of the adjoining bones, while the latter become emaciated in substance though not diminished in size, through the same lack of supply of nutritive material. The nerves share in the atrophy of the connective tissue, the medulla becomes compressed resulting in hyperæsthesia with diminution of proper function. Sometimes anæsthesia occurs, and between these extremes are the various forms of perverted sensation. The motor function exhibits an equal variety of failures and perversions on a lower level of nutrition than that which gives it its natural trophic action. The skin shares in the same atrophy, its arteries diminishing and its veins becoming obliterated, the surface acquiring the appearance of cicatrical substance with a shining aspect.

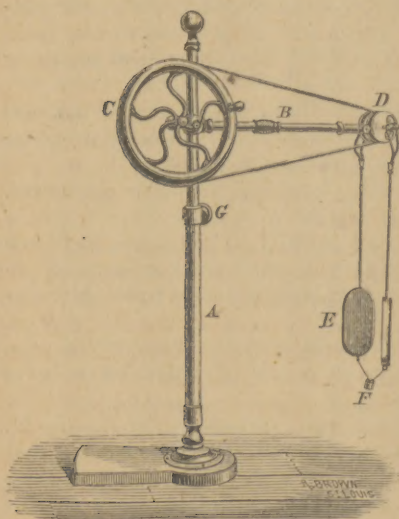


FIG. 1.

A—A stand, capable of being lengthened, so as to control the height of the working portion of the apparatus.

B—Horizontal shaft, capable of being lengthened so as to keep the band tight.

C—Wheel propelling the band which carries the small wheel.

D—The wheel which moves two friction pads.

E—Pads with wooden foundation and leather-covered cushioning. In operation, those pads are covered by some fabric capable of being washed. One pad may be used alone, or it may be substituted by a brush.

F—An elastic rubber connection for controlling the position and relation of the pads.

G—A set screw to hold the working part of the machine at a proper height.

A vibratory attachment for hand or foot is also run by the same wheel which carries the friction pads, the latter being detached and laid aside.

This assemblage of conditions may be peripheral, or the sequel of an injury, or other local cause, on the one hand; or, on the other hand, central, the result of changes in the nervous centers, in consequence of which the arteries are made to contract under the irritation conveyed through the nervous distribution.

The arterial and the nervous systems react upon each other, the diminution of arterial blood lessening the nutrition of the nerves, and the consequent perversion of the nervous function inducing an increased contraction of the arteries. The influence of the defective supply of arterial blood is illustrated by what is said of some devotees in India who carry an arm elevated and deprived of its proper movements for a long time. The ascent of the blood in the arteries is retarded by the force of gravity, and its descent in the veins is favored, so that the limb emaciates and stiffens. The same result, in a minor degree, occurs as an incident to the treatment of diseases and injuries in which immobility and an elevated posture are preserved for many weeks. In these cases, the increased accumulation of blood attending the dependent posture becomes painful, and the diminished capacity of the capillaries to transmit the blood, and of the veins to return it, result in the effusion of serum, producing swelling and pitting, which are slow in being removed.

The recovery in such cases is generally retarded by the unwillingness of the patient to submit to the pain attending the dependent posture, and the movements, the pressures, and the frictions which should be employed to induce a better vascular supply. The heat and cold alternations by bathing, the atmospheric exhaustion by cupping, and the electric excitations, are all painful except in those conditions in which there is palsy of sensation of a durable nature. This explains the reason why so much advantage results from the occasional etherization of a patient whose fortitude is not equal to the emergency.

The treatment of diseases of this class is the opposite to that adapted to conditions of inflammatory nature. In this latter condition the arteries are dilated, permitting too much blood to flow. Here the elevated posture; rest and arterial sedatives are appropriate, while in the former condition, all modes of activity are useful.

The point of uncertainty with regard to the class of therapeutic agents most appropriate, is in the border-land between active inflammation and the passive condition which follows. There is too much blood in a part which is the seat of chronic inflammation, the vessels being too large and too numerous. If too much activity attends the treatment, the acute form of the disease is reproduced and great harm is done. All forms of massage are more likely to be followed by injury than is the employment of cold and heat in quick alternation. The agent next to temperature in bathing, which is likely to contract the vessels without an unpleasant reaction, is the negative pole of a continuous galvanic current. The blood vessels are inclined to contract at the same time that there is the production of faint electrolysis, the oxygen and the acids being drawn away from the parts under treatment, very much as the abstraction of oxygen

tends to quench a flame, while the hydrogen and alkalies remain. These latter are incapable of inducing those chemical changes which develop heat, and hence the contra-stimulant effect.

The application of the positive pole would be likely to excite the inflammation to increased action. If, however, the case has passed entirely beyond the condition of heat, indicated by the disappearance of an elevated temperature, the positive pole may be found most advantageous.

The use of Seguin's flat bulb thermometer for the determination of variations of temperature is very satisfactory.

When the progress of disease has passed to a condition of fitness for the positive pole of the galvanic current, it may be considered safe to employ massage, lightly and cautiously at first, and with more boldness as it is found safe.

An illustration is found in two hands presented for examination the same day. One was that of an old man, with subluxation of the thumb of three weeks' duration, stiff, hyperæsthetic, and without elevation of temperature. The other was that of a youth of seventeen years, with subluxation of the wrist of several weeks' duration, the temperature being one degree higher than that of the opposite side. In the first case the skin had begun to be slightly glistening, while in the other case the skin presented its natural appearance, and was very slightly rounded up from swelling.

These two cases presented conditions very different, though the injuries were originally sprains. In the case of the youth the activities were too great, requiring a reduction of temperature by cooling applications, with the greatest possible quietude of the inflamed parts; while the hyperæsthesia in the other case was best controlled by raising the nutritive activity of the part. The nerves ceased to be painful and extra-sensitive as they became better nourished. Rubbing, pinching and passive motion, the quick alternation of hot and cold water and electric excitation, all acted in the same direction, the only caution being not to carry any of these applications too far at any one time.

It sometimes occurs that lowered action is attended by *paroxysmal* elevation of temperature. The truly inflammatory action is attended by *persistent* elevation of temperature. In the temperature more than in any other condition, is to be found the test as to fitness of quiet and coolness on one hand, or motion and heat on the other.

It appears from these considerations, that pain should be disregarded in determining the question of the prolongation of rest, or the employment of disturbing agents. The persistence of an elevated temperature is the best criterion.

Antrophy with Hyperæsthesia following an injury of the left ankle—June 9, 1870: Miss C. G., aged twenty years, received a severe sprain and perhaps a fracture of the left ankle, about two years ago. She never recovered, and for the last eight months has lain in bed. The limb has generally been cold and blue, and subject to occasional attacks of heat, on ac-

count of which cold water has been applied, while during the time of coldness, hot water has been found most agreeable. The general appearance of the patient is that of emaciation and feebleness, and she has partly lost the use of the right lower limb from long confinement. The foot is slightly swollen, and is very sensitive to pressure. Movement is painful, and all these symptoms are most manifest in the toes. There is no voluntary power of moving the ankle or the toes. The foot is carefully carried upon a pillow, and she lives in constant dread of motion occasioned by the contact of objects, or the movements of her own body.

The interpretation of the case is that there was an injury followed by a condition of inflammation, and that in the process of recovery through the period of chronic subsidence, a hysteroid or other constitutional cause has led to an exaltation of sensitiveness to touch, leading to the quietude which favors diminution or perversion of function. The nourishment of the tissues is supposed to be insufficient, and were it possible, the natural use of the foot would be the best remedy. The pain attendant upon any disturbance of the limb is sufficient to suppress any voluntary effort. It sometimes fails to be appreciated that when the nutrition of a nerve is below par, it is most painful. In this view of the subject, it is proposed to employ friction, passive motion, faradization, atmospheric exhaustion, iron, quinia and exercise.

The treatment was entered upon with the promise of the aid of the patient. The frictions were made daily by hand thoroughly smeared with lard, and the tolerance always increased with the progress of the rubbing. Jened's boot had the effect of reddening and warming the limb. The contracted tendo Achillis yielded with difficulty, and a very effective device was a swing in which the patient, in a sitting posture, rested the foot upon a vibrating foot-piece. This served to secure motion in the ankle-joint, and the vibratory motion elongated the tendon. The improvement was very gradual, but without any period of retrogression. The treatment lasted thirty-seven weeks, and the restoration was finally complete.

There is no probability that the foot of the patient would have ever been restored to the function of walking without first disregarding the fear of pain by disturbing processes. The amount of time and perseverance is not appreciated by those who have not paid especial attention to the subject.

February, 1880.—The patient has remained in good health, with a good use of the foot.

Perverted innervation of right foot following Sprain. Hyperæsthesia and swelling.—September, 2 1872: Miss L. L., aged fifteen years, sprained the tarsus of the right foot one year ago, producing lameness which did not subside. Six months afterward the tarsus was sprained again, and the patient has not walked since.

Much swelling is said to have been produced by the first injury, and reproduced by the second sprain; but at the present time there is but little swelling, and no elevation of temperature. There is tenderness on

movement of the tarsal joints. The foot is intolerant of the weight of the body.

The continuous galvanic current from seventy cells, for thirty minutes, diminished the hyperæsthesia and increased the sense of warmth, without increasing the heat perceptible by the hand of another person.

September 7.—Galvanization is employed five minutes, and friction by the lubricated hand five minutes each day. Elixir of pyrophosphate of iron is employed as a tonic.

September 14.—Some weight can be borne upon the foot.

September 24.—She plays croquet without crutches.

April 15, 1873.—A letter states there have been a few attacks of lameness of short duration.

October, 1877.—The patient made us a visit. She is now married, and has never had a return of lameness.

These two cases were treated without machinery adapted to the purpose of massage. Much labor would have been saved by such apparatus as has been referred to in this paper.

The modes of treatment discussed in this paper are not only not in antagonism with the treatment by medicines, but they are aiding and aided by an intelligent combination. It would be as reasonable to single out any medicine, and undertake to treat a great variety of diseases by it alone, as to apply indiscriminately either of these four remedies.

From this presentation of the subject, it is probable that a water-cure establishment without mechanical apparatus for massage; and a movement cure without bathing and electric appliances, will come to be regarded as defective in the necessary range of application to the indications in chronic diseases, disabilities and deformities.

The expense attending the procuring of a complete outfit for the employment of these agents, and the care necessary to keep them in order, must make it difficult to realize the best results except in institutions.

PSORASIS AND ECZEMA.

There are two ways of explaining the effects of electric excitation in these two affections of the skin. One is the supposed influence upon innervations and a consequent control over nutrition.

The effect of applications to distant parts acting by reflex agencies, the instantaneous influence upon internal parts produced by heat or cold, and the influence of drafts of air, must be explained in this way.

The faradization or galvanization of the spine for shingles (*herpes zoster*) is made upon the theory of a primary influence upon the nerves; the impression upon the nerves in the spinal cord being communicated to their extremities.

The other explanation is a chemical one, and in accordance with this theory, the negative pole of the continuous or galvanic current is found to be the most effective. The oxygen is withdrawn from the parts to which the negative pole is applied, and the oxydation and consequent heat is thus diminished. The redness of the surface becomes diminished, and

the itching and burning for the time disappears. The positive pole fails to secure the amelioration of the sense of heat and itching. On the other hand, a pure pain is generally most benefited by the positive pole, and the theory is, that a pure pain is the result of a diminished supply of blood in the nerves, in which the pain is seated. The flow of oxygen toward the positive pole which is applied, as near as practicable, to the seat of pain, increases the oxydation of the blood, and the consequent increase of heat and molecular transformation diminish the irritant effect of the imperfectly oxydated blood upon the muscular fibres of the vessels. These fibres relax, the arteries fill with blood, and with the normal, or perhaps, with the excessive supply of blood, the pain ceases.

The prodromic pains which precede fevers, are explained on this principle. The vascular contraction is attended by pain, while the vascular relaxation which attends fever, is rarely painful; although the discomfort may be very great. The explanation of the pleasant effect of heat when applied to painful parts is best made in the same direction.

Again: the effect of the faradic current in alleviating pain, finds its most ready explanation in a mechanical way. The muscles are induced to contract and relax with great rapidity, whether the current is applied to the nerve trunks or to the muscles themselves. The exercise of the muscles brings more blood into them, as much so as if the exercise were voluntary. The presence of blood implies the expansion of the blood-vessels; this implies increased oxydation and heat, with attendant increase of molecular transformation.

Thus, in many cases, the faradic current accomplishes, though less perfectly, what is more readily attained by the positive pole of the galvanic current.

In this view the effect of friction and vibration may be explained. In massage, whether performed by the hand or by machinery, there is friction upon the surface and vibration of the deeper tissues. The temperature is directly increased by the friction as in the rubbing together of two lifeless substances, and indirectly by the vibration of the parts accelerating the flow of blood in the parts acted upon; the more rapid flow brings more rapid chemical action: the nervous inhibition which secures arterial contraction is diminished, and the vessels relax or expand.

The muscles increase in volume and strength, with the increased molecular change, and the nerves forget their perversities. While the incipency of the action is different in the different agents here spoken of, they coincide in their therapeutic action. The positive pole of the galvanic battery, the current of the induction coil, (faradic) and the friction and vibration, whether by hand or by machinery, require the absence of a truly inflammatory condition. The condition of increase of heat, (compared with the neighboring parts) generally contra indicates these agents. The negative pole can be borne in cases in which the positive pole will be injurious, but it is safe to say that where cold applications are comfortable, massage and

electricity are generally out of the question—except in some cases in which the negative pole may be borne.

While this page was being written, the following case of *Hyperæsthesia of the ankle joint, with diminished temperature, the absence of swelling, dependent upon defective menstrual function* was presented;

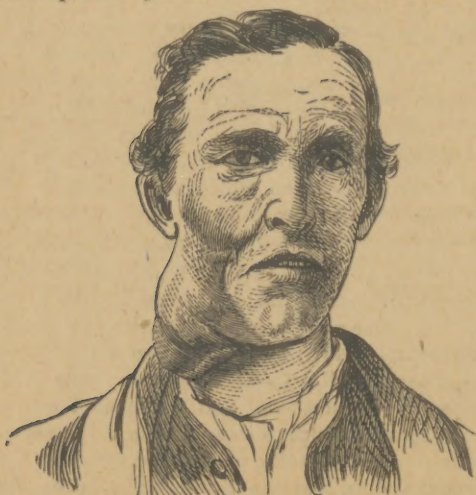
Miss D., aged 15—two years in menstrual life, has been on crutches for three weeks, in consequence of lameness of the right ankle preventing the placing the foot upon the floor. The foot was cold in comparison with the other, not swollen and not tender on pressure except over the joint. The patient came on crutches with a shawl wrapped around the foot. There was a statement of menstrual irregularity.

Friction and vibration were freely employed by Taylor's manipulator without pain, except when pressure was made directly upon the joint, and without any feeling of discomfort.

After ten minutes the patient placed her weight upon the lame foot. In two hours the same treatment was repeated, followed by a faradization, after which a dress shoe was put on, and the patient walked where she pleased, with only a slight degree of lameness.

The following case was treated by the writer in the beginning of his experience in the use of galvanism for the dispersion of morbid growths. The case was published in a report upon Galvano-Therapeutics, made to the Illinois State Medical Society, in 1873.

Case of infiltrated epithelial growth in the sub-parotideal region, of two years' duration. The failure of dissection to remove the whole of the tumor. Growth under the influence of irritative electrolyzation. Partial removal again by the knife. The current again employed with wide distribution, with rapid absorption of the infiltrated material.



May 28, 1872.—Elijah A. Reynolds, aged 40, in May, 1870, perceived a small tumor under the angle of the right lower jaw, but not sensitive to the touch. In August it began to grow rapidly. In October, it diminished in size. In May, 1871, it began to grow again. In January, 1872, it began to be painful, and continued painful to the present time. It has grown perceptibly during the last month. A small additional tumor is perceptible under the jaw, near the median line.

FIG. 2. Elijah A. Reynolds previous to treatment.

The accompanying cut—Fig. 2.—exhibits the appearance of the tumor previous to its dissection.

Operation under chloroform. The dissection was commenced from below, and the tumor was found to have no membranous enclosure, but to be incorporated with the tissues surrounding it. It broke up readily under the pressure of the finger, and its deep surface not only dipped into the muscles, but the muscles themselves were rendered hard and rigid by the infiltration of the same material.

It was not thought prudent to attempt the complete removal of the morbid material, but to apply electrolysis after a few days. Under the glass, no caudate cells were discovered, and such cells as could be distinguished, had very much the appearance of those found in epithelial growths. The history of the tumor, and the appearance of its contents to the naked eye, were those of encephaloid disease.

The patient had been prepared for the operation by a cathartic the night before, and five grains of quinine in place of breakfast. A few hours after the operation, $\frac{1}{4}$ grain of morphia with 30 grains hyd. chloral was given. The wound was left open and kept covered with a piece of old muslin, saturated with a solution of carbolic acid of four grains to the ounce.

June 1st.—Wound cleaning out and granulating well; the patient kept up on the use of 7 grains of citrate of iron and quinine three times a day.

June 4th.—The seventh day from the operation; the use of the galvanic current was commenced, applying the needles directly to the surface, with reference to the destruction of the tissues. The poles were exchanged to see which pole would have the best effect. A flat metallic plate was also employed, covered with wet Canton flannel.

Though apparently successful at first, the tumor grew again, and one month after the first operation, viz:

June 29th.—A second operation was made. No attempt was made to remove the whole of the morbid material. Several vessels were tied or acupressed. Only compressed epithelial cells were discovered under the microscope.

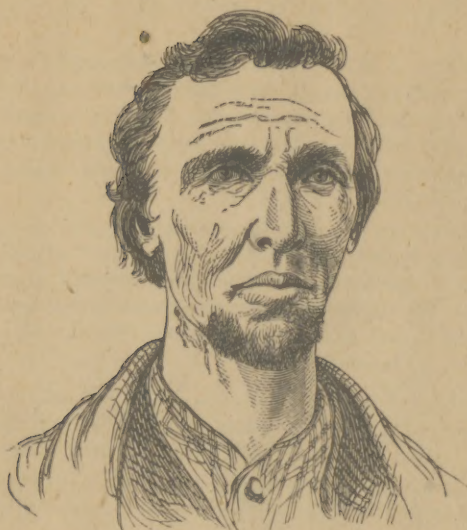
From this time, the galvanization was employed for thirty minutes, twice a day, by a large sponge, as the positive pole of a galvanic battery of 100 Hill cells. The full power of the battery was generally borne. After a month the galvanic current was employed twice a week.

The cicatrization finally became complete.

September, 1873.—The health good.

February, 1880.—Mr. Reynolds has had good health, without a return of the local disease, and has constantly worked on his farm near Jacksonville.

Fig. 3, is that of the patient after the completion of cicatrization.



With regard to this case, it may be said, that if the growth was not cancerous, but scrofulous or cachectic, the power of the galvanic current to arrest this last kind of morbid degeneration is at least vindicated. As far as the reproduction of a tumor is evidence of malignancy, so far, any agent may be said to be a remedy for malignant formations which has the power to arrest this secondary growth.

The history of this case shows that the power is not one of destruction, as the growth increased during the employment of the current for electrolysis, but an agent which directly promotes a healthy nutrition.

FIG. 3 Elijah A. Reynolds subsequent to treatment.

Epithelioma of the middle of the anterior surface of the left fore-arm.

Mrs. S., aged 29, mother of several children and of previous good health, had a numbness of the fore-arm, and in a few days a small tumor was observed. The tumor at length, in the twenty-seventh month of its growth, ulcerated, and was extirpated by Dr. Bartlett, of Virden. In a week the tumor began to grow again, and caustics were applied.

August 25, 1874.—One month after the excision. The treatment by galvanism was commenced by applying a sponge as the positive pole, employing 130 Hill cells twenty minutes at a time, twice a day, the negative pole being divided so that one sponge was held in the hand of the other side, and the other sponge applied to the opposite side of the same fore arm.

October 8.—The treatment has been kept up fifty days. The thickening has entirely disappeared, and the ulcer has healed, except a mere line in the direction of the length of the limb.

No pain was felt after the treatment had been going on three days.

February, 1880.—There has been no return of the local disease and the patient has remained well, having had two more children since the treatment.

One of the best instances of the influence of the constant current over nutrition and innervation is the control or suppression of epilepsy by the galvanization of the spine; the position pole being applied to the back of the neck, and the negative to the sacrum.